Space Weather Technical Forecast

Issued on Friday, 12 April 2024 at 01:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of Moderate activity. Slight chance of G1 Minor geomagnetic storms on 13 and 14 Apr.

Solar Activity: Solar activity has been Moderate, with a peak flare of M5.4 at 11/1706 UTC from a region behind the east limb. On the visible disc there are five sunspot regions. Of these AR3633 and AR3634 are moderately magnetically complex. The remaining regions are magnetically simpler, although despite this AR3635 in the far northeast has been the most active region on the visible disc, while increasing in area over the past 24 hours.
Two filament eruptions were observed leaving the north-central disc early on 11 Apr. The associated CME's have been analysed and are not expected to be Earth directed.

Solar Wind / Geomagnetic Activity: Solar wind speeds, as observed at L1 averaged between approximately 400-500km/s for much of the day, later declining closer to 400 km/s as the Earth remained under the residual influence of a high speed stream from coronal hole 22. Density has been around average. The total magnetic field strength was weak throughout with the north-south component also varying weakly between -5nT and +6nT. Phi angle was predominantly positive (towards the Sun) but with brief incursions into the negative sector. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at background levels.
High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels. The associated 24-hour fluence remained well below the Active (1e8 integrated flux) threshold, on a decreasing trend, with a value of 7.04e6 integrated pfu recorded at 12/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to start at Low levels, but with an increasing chance of Moderate activity as significant returning regions rotate onto the visible disc.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. Solar wind speeds are expected to continue to decline through today as the high speed stream from coronal hole 22 wanes. The high speed stream from coronal hole 24 is then expected to connect with Earth through 13 and 14 Apr, with speeds of 450-500km/s forecast. Geomagnetic activity is forecast to be mainly Quiet to Unsettled today, and again day 4 (15th Apr). Unsettled to Active intervals are then possible on 13 or 14 Apr as the next high speed stream connects. Depending in the strength of the connection, there is a risk of G1/Minor Storms (Kp 5).

Energetic Particles / Solar Radiation: High energy proton flux as observed by GOES-18 is expected to persist at background levels. High energy electron flux at GOES16 is expected to continue at background to moderate levels. The associated 24-hour electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

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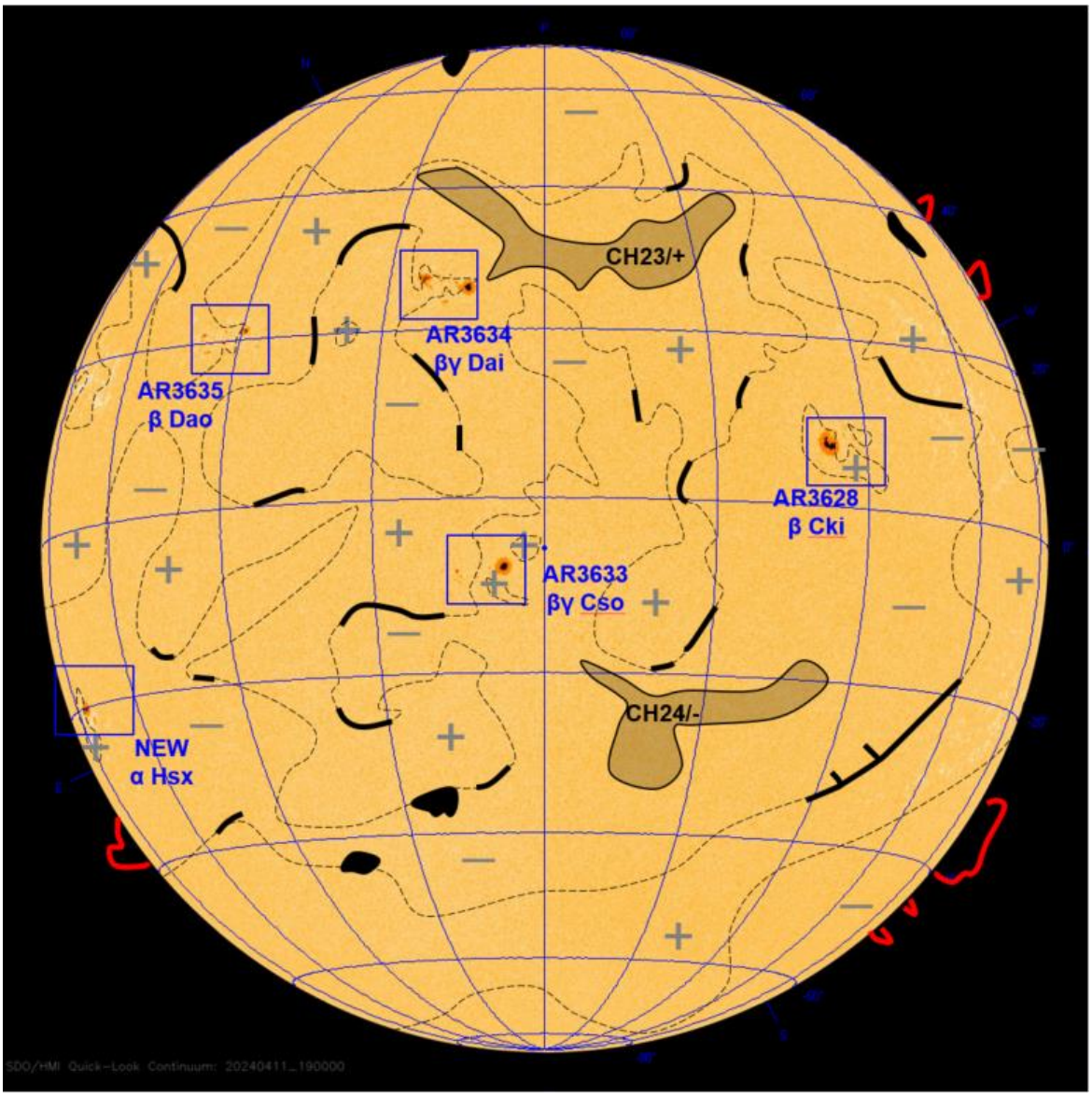
Figure 1. Solar Analysis Valid 11/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

Two filament eruptions were observed emanating from the north-centre disc early on 11 Apr have been analysed and are not expected to be Earth directed.

Otherwise the Earth is under the declining influence of the high speed stream from coronal hole 22, with the solar winds expected to decrease to background levels today. The high speed stream from coronal hole 24 is then forecast to connect with Earth through 13 and 14 Apr. On the last rotation, this recurrent feature produced a solar wind speed of around 400-450km/s. As the coronal hole is slightly larger on this rotation, speeds may reach 450-500km/s. Enlil modelling is predicting a current high speed stream of close to 600km/s, but as the model is forecasting that this should already be affecting the Earth, Enlil is considered to be erroneous. Geomagnetic activity is forecast to be mainly Quiet to Unsettled today, and again day 4 (15th Apr). Unsettled to Active intervals are then possible on 13 or 14 Apr as the next high speed stream connects. Depending in the strength of the connection, there is a risk of G1/Minor Storms (Kp 5).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	30	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X-Ray Flares:

There are five sunspots on the visible disc. AR3628 has evolved and is now classified at Cki/beta. AR3633 has increased slightly in spot number, gaining small leading spots which have increased its magnetic complexity to become beta-gamma. However, the penumbra on the trailing spots has faded, with the group now classified as Cso/beta-gamma. AR3634 has continued to increase in area, with penumbra enlarging on trailing spots. AR3635 has also increased in area, due to penumbra development on trailing spots, and has been the most active region on the visible disc. Newly numbered AR3636 near the southeast limb is currently difficult to analyse fully.

Solar activity has been Moderate, with a M5.4 flare peaking at 11/1706 UTC from a region behind the east limb. Generally Low activity is expected, but with an increasing chance of reaching Moderate levels. The majority of this increasing activity is expected from regions approaching the east limb, with previous regions AR3614 and AR3615 both potentially returning within approximately 24 hours.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

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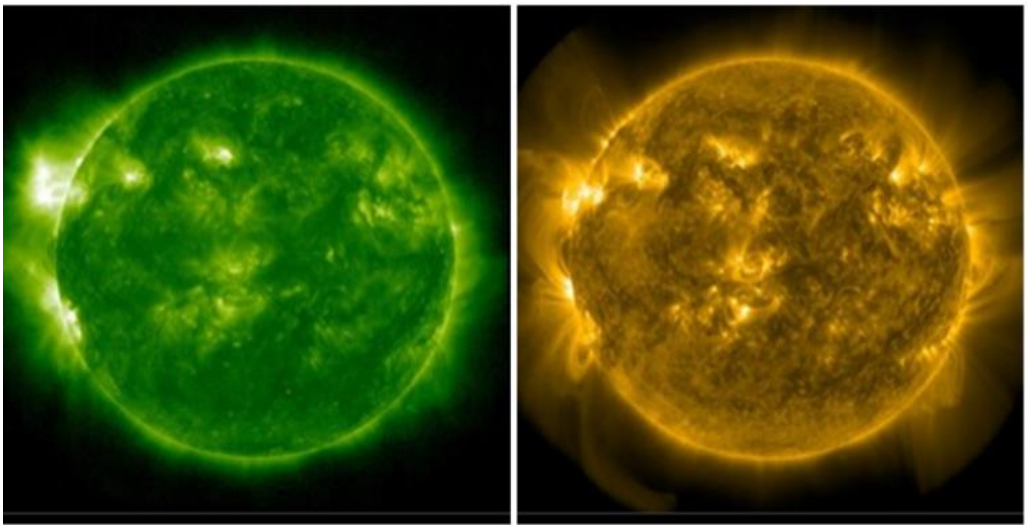
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	30	45	45	45
Very Active	R3 to R5 X Class	No	1	5	5	5

Figure 2: Latest SDO/AIA images (left 094 and right 171) showing bright flux and magnetic looping on or behind the east limb, heralding the arrival of significant regions within approximately 24 hours.



Solar Radiation Storms - (High Energy Protons):

High energy proton flux as observed by GOES18 is at background levels. Solar radiation storms are considered a background risk during the period given the lack of appropriately active sunspot regions moving into in the western portion of the disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux is currently oscillating between background and moderate on diurnal variations. This pattern is expected to continue through today under the influence of a

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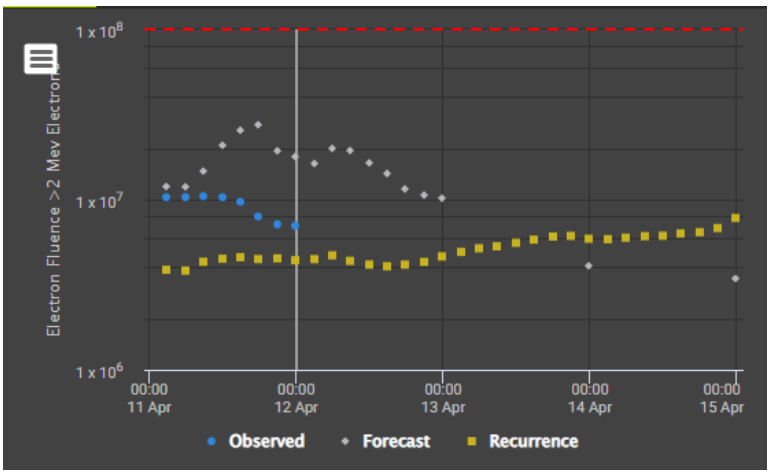
weakening high speed stream. The next forecast high speed stream is expected to arrive tomorrow (13th Apr) which may lead to a slight decrease followed by increased diurnal peaks. There is a slight chance of the High (1e3pfu) threshold being reached towards the end of the period.
Electron fluence values are at background levels. Despite a likely rising trend, following the onset of the next high speed stream, the Active (1e8 integrated pfu) threshold is not expected to be reached. Therefore the Met Office REFM model is considered to be giving overall good guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	5	10	20
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model.



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